Visualizing Freight Data and Freight System Operation

A useful, perhaps essential tool, but don’t expect a crystal ball!

R. Hughes, M. Manore, S. Karthikeyan

TRB Visualization in Transportation Committee (ABJ95)
Adrift in a Sea of Data

Commodity Flow Survey
Rail Waybill Data
GeoFreight
Pipeline Safety Statistics
Vehicle Travel Information System
US Army Corps of Engineers Navigation Data Center
Truck Transportation, Messenger Services and Warehousing
Motor Carrier Financial and Operating Statistics

National Transportation Atlas Database
Freight Analysis Framework
Vehicle Inventory and Use Survey
Oil Pipeline Statistics
Highway Statistics
Maritime Statistics
Transborder Freight Data
Without a chart and a compass
Perhaps, perhaps not

Our projections of demand give us an image of the ‘destination’ . . . but not necessarily the process/path for getting there
We have described **the problem** in statistical, numerical terms and visualized (the problem) in traditional ‘presentation graphics’.
We have visualized these projected trends in terms of the impact on major freight corridors for truck and rail... and in words that can all can easily visualize and understand.

Every freight truck on the road today will have one more behind it.

Every second railcar on the network today will have one more railcar behind it.
The Four Major Drivers Behind the Increasing freight demand are
(according to Grunzeback, March 21, 2007)

Consumption
• Population Growth

Trade
• Import and export growth

Production
• Expanding durable and non-durable Goods manufacturing

Supply Chain Practices
• Changing logistics strategies
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Do we need a revolutionary change in a freight system of the future?
INNOVATIONS

Isn’t that why we are here?
An ‘Expanded’ Discussion on the Potential for Visualization will be included in the Proceedings of the Symposium.

Some Thoughts on Data Visualization in the Domain of Freight Operations

Presented by Hughes, Manore, and Karthikeyan
TRB Visualization in Transportation Committee
ABJ95

Innovations in Freight Demand Modeling and Data: A Transportation Research Board SHRP 2 Symposium

September 14-15, 2010

http://www.itre.ncsu.edu/VAMS/cmv/freight.html
Visualization in the freight domain will increasingly involve the integration of new thinking from the areas of computer science. ‘VISUAL ANALYTICS’ is more of a computer science discipline than the conventional 3D/4D transportation visualization approach to which we have become accustomed.
As humans, we ‘consume’ information (data) visually.

The eye can, in fact, process more information than can be presented by current high resolution displays.
And certainly more than is presented in tables, simple 2D graphics and charts
We have difficulty using data to effectively conceptualize the multi-dimensional structure and operation of the ‘system’ as a whole in large part because

• conventional analysis tools do not permit us to interact ‘fully’ with the entirety of the data (in part, a data architecture problem)

• and do not optimize our ability to visually process the outcomes of those analyses through scalable, linked perspective displays of the data
Visual Analytics
(for freight data visualization)

3D-4D
Data visualization requires different tools than roadway design visualization

- Different analysis tools
- Different data architectures
- More informative user interfaces and displays of results
A Preliminary Roadmap for Freight Data Visualization

in the context of C20 and beyond

**Doing our homework**
- Stakeholder differences
- Leading Freight Issues
- Key decisions (current & desired)
- The Data needed to support decisions
- Current Data
- Ideas for visualization to inspire alternative analysis approaches

**Incorporate** into **C20 Strategic Plan**; include proposed research agenda

**Exploring current data** using Visualization methods

**Visualizing output** of Freight Demand Models

**Improve User Interfaces** to assist decision-makers

**Exploring feasibility** of system-level analysis (e.g. Visual Analytics)

**Developing system-level measurement** concepts and applications with emphasis on multi-modal integration

**New Insights:**
- On Demand Models
- For New Data
- For Existing Data
- Better ways to Interact

**Contribute to the Strategic Freight Roadmap**

**Ongoing research in freight performance measures**

**Future freight data performance measurement Research w/ Visualization**

**Expand upon and integrate with system level concepts**

**A Preliminary Roadmap for Freight Data Visualization in the context of C20 and beyond**
Next Steps

A Parallel Attack on Two Paths

Path 1: Doing our *systems level* homework

1) Identify key federal and state level ‘stakeholders’

2) Identify data elements and key system variables

3) Identify key ‘decisions’ and ‘desired outcomes’

4) Define the structure of *system* operation
The **BIGGEST CHALLENGE** for the facilitators was in getting participants from different professional backgrounds focused on the intent of the workshop and on rising above their own professional needs to **“SEE THE BIG PICTURE” AND “THINK OUTSIDE THE BOX”** when it comes to future needs and priorities of freight modeling and data.
Next Steps

Path 2: Conducting ‘Exploratory’ Visualization Work simultaneously at two levels:

Level 1: Applications of conventional data visualization methods and applications

Level 2: Prototype applications of new visualization and computational methods (e.g., Visual Analytics)

1) Provide VA experts exposure to freight data sets

2) Develop a common (XML) platform and data structure

3) Develop and demonstrate analysis methods and prototype visualization/visual analytics applications
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